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INSTRUCTION MANUAL

MICROSENSE 3046/310

WAFER GAGE

(617) 923-2180

ADE CORPORATION
Watertown, Mass. 02172

WARRANTY

ADE warrants to the original purchaser that the equipment delivered hereunder will be free from defects in materials and workmanship under normal use and service when assembled, installed and operated in full accordance with all ADE's applicable instructions. This warranty does not apply to any defects in said equipment or damage thereto resulting from accident, alteration, misuse, abuse, tampering, operating on low or excessive voltages or from any other unusual or abnormal conditions which shall occur after the equipment leaves ADE's factory.

The obligation of ADE hereunder is limited to the repair, rework or replacement at ADE's option of any equipment or component thereof which within six months from the date of initial delivery is returned to ADE's Watertown, Massachusetts factory, all shipping and other charges incident thereto prepaid, and which ADE's examination discloses to its satisfaction to have been defective in materials and workmanship within the terms of this warranty. Should ADE, after examining returned equipment, determine that a defect therein is not one which it is obligated hereunder to remedy, ADE will promptly submit an estimate of repair charges to Buyer and shall obtain Buyer's authorization for repair in accordance with those charges before the equipment is serviced.

Notwithstanding any other terms hereof, in no event shall ADE be liable under this warranty or under any warranty or condition, whether express or implied, for any remote or consequential loss or damages resulting from any defect in the equipment or components thereof delivered hereunder.

This sets forth ADE's sole warranty with respect to the equipment. ADE MAKES NO OTHER WARRANTIES OF ANY KIND WHATEVER, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, ALL OF WHICH ARE HEREBY DISCLAIMED BY ADE. No agent of ADE, nor any individual or corporation purporting to act on ADE's behalf, is authorized to add to, alter, or otherwise change these warranty provisions without the express written authorization of an ADE corporate officer.

LIMITS OF RESPONSIBILITY

The equipment described herein may be integrated into a larger more complex system or into a critical production process by the customer. In such case ADE Corporation shall assume the conditions and responsibilities stated in the Warranty for the performance of ADE equipment as stated in the ADE Sales Order, Quotation, Equipment Specification, Manual or other literature written and authorized by ADE Corporation stating performance or specification of said equipment.

In the event that ADE equipment is integrated into such a system, the ADE equipment performance, or specification of performance within the system is clearly stated as a separate Line Item on the ADE Sales Order. It is strongly recommended that to insure proper operation and longevity of ADE equipment in a system:

1. A liason engineer should be designated within the customer facility to familiarize himself with the ADE equipment to the degree required to insure proper interface with the system and proper function within the system before the equipment is installed and to supervise that installation.

2. Purchase should be made of a minimum of two days of engineering installation and interfacing assistance and familiarization instruction by an ADE field service engineer to assure optimum use of the ADE equipment in the particular application.

3. Suitable spare parts be purchased as specified on the ADE Quotation for interchange in the event of damage due to mechanical system failure or other causes.

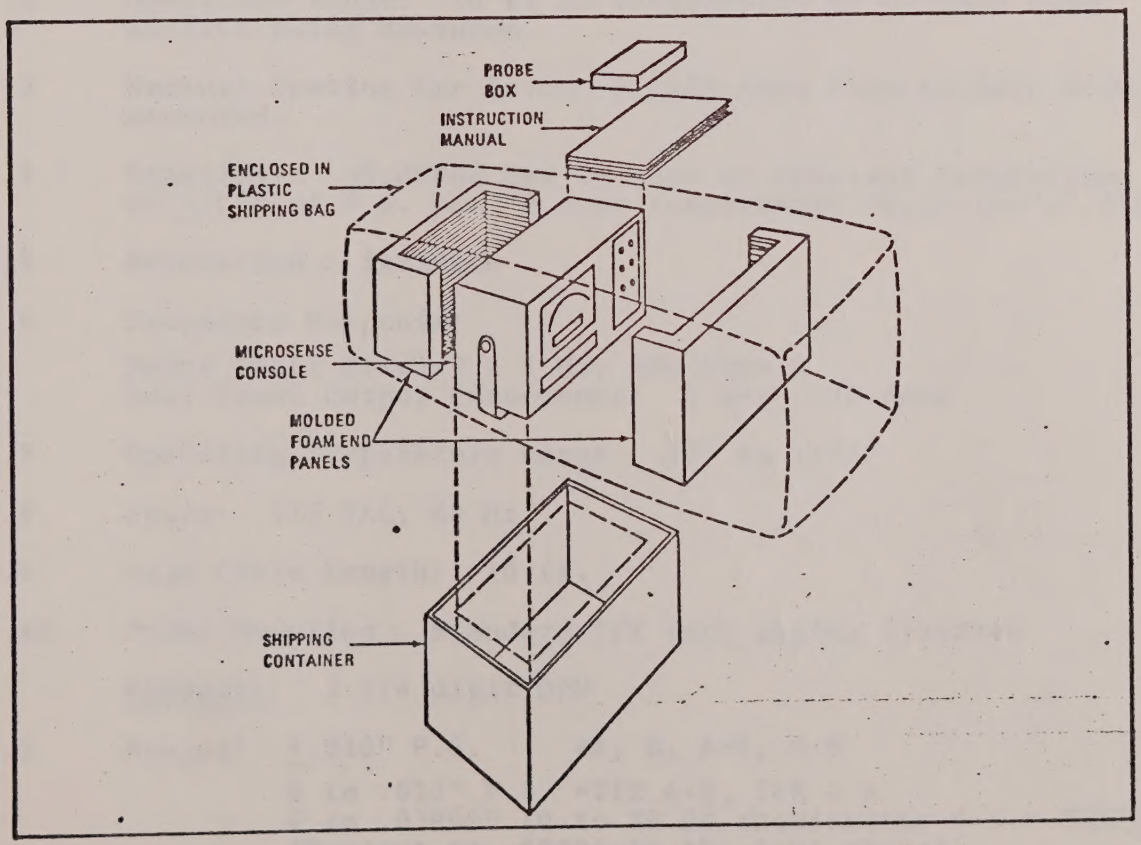
ADE Corporation does not assume responsibility for the installation into the system or the operation of the entire customer system.

UNPACKING

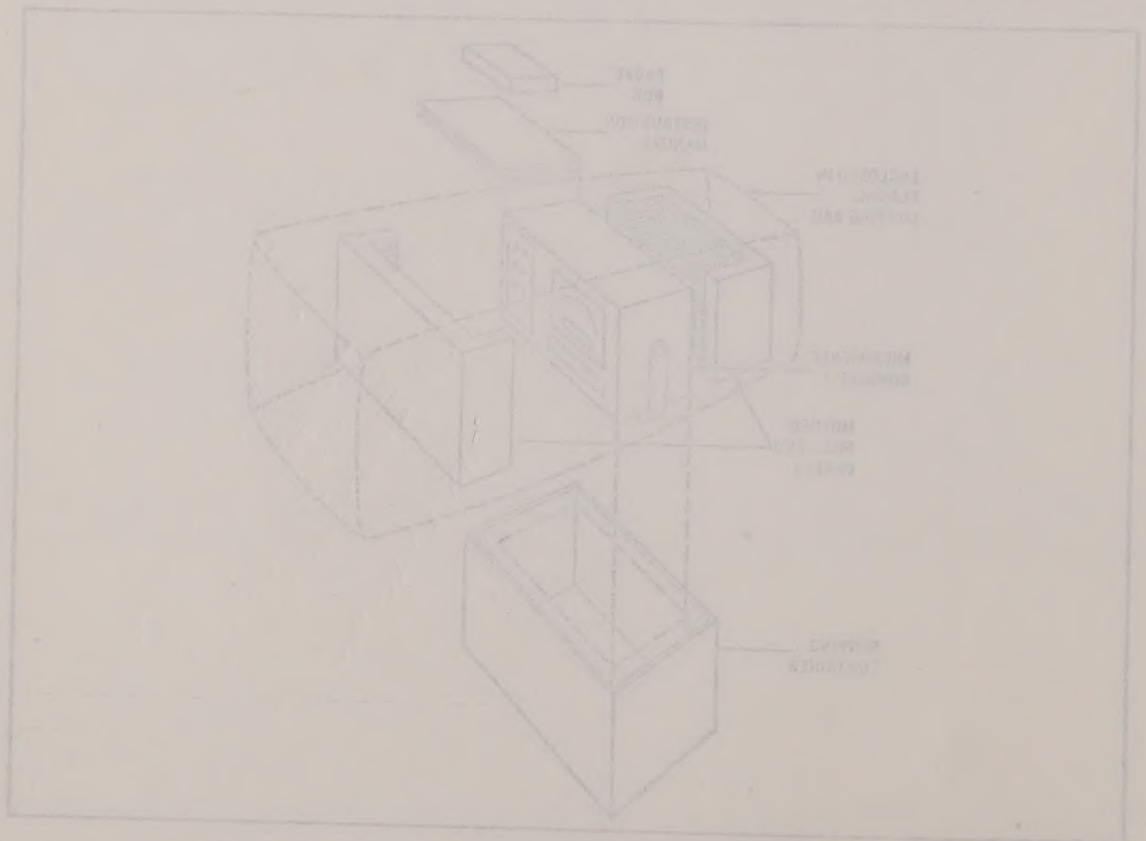
The Microsense console is packaged in the factory to withstand normal shipping and handling. The diagram below shows the configuration of the packaging materials in a shipping container.

After carefully unpacking the console, insure that all items listed on the shipping invoice are included in the container. It is recommended that the shipping container and the molded foam end panels be retained in which to store the console. If required, it may be used to ship the console back to ADE Corporation for repair or calibration.

The probes supplied with the console are individually wrapped in their own box and then inserted in the shipping container.



UNPACKING



1.0 Specifications

1.1 General

The ADE Corporation Microsense 3046 Two-Channel Non-Contact gaging system is especially suited to making static or dynamic displacement measurements on two surfaces without disturbing the setup, and to making thickness and step height measurements. It consists of the 3046 readout console together with two probes each made up of 2001 driver and a 2101 tip.

1.1.1 Modes of Operation and Range

A- (CH A Displacement), ±0.010" F.S.
B- (CH B Displacement), ±0.010" F.S.
A+B- (Thickness Deviation), ±0.010" F.S.
A-B- (Centerline Deviation), ±0.010" F.S.
TIR (A+B)- Taper, 0-0.010" F.S.
TIR (A-B)- Bow, 0-0.010" F.S.

1.1.2 Operating Range: 10 to 35 thousandths of an inch from surface being measured.

1.1.3 Nominal Spacing for Zero : 0.0225 inch from surface being measured.

1.1.4 Stability: ±0.00001 per 24 hour at constant temperature or ±.03% of F.S. per °F over temperature range (on "a" range).

1.1.5 Resolution : infinite

1.1.6 Frequency Response:

Front Panel Display : 1 Hz, 3db down
Rear Panel Output Connectors: 1 kHz 3db down

1.1.7 Operating Temperature Range: 40° to 120°F

1.1.8 Power: 115 VAC, 60 Hz

1.1.9 Gage Cable Length: 10 ft.

1.1.10 Probe Mounting : Standard 3/8 inch gaging fixtures

1.2 Readouts: 3-3/4 digit DPM

1.2.1 Ranges: ±.010" F.S. =A, B, A+B, A-B
0 to .010" F.S. =TIR A+B, TIR A-B
0 to .03999" (0 to 39.99 thousandths F.S.= THK(A+B))
(Readout to .00001 in the last place)

Accuracy: 2% of total full scale range of all points on scale.

1.2.2 Tolerance Limit Lights: "LOW LIMIT" and "HIGH LIMIT"

1.2.3 On-Off Light

1.2.4 "OVER RANGE" Light: In the "A" or "B" modes this light comes on when reading is beyond full scale. In the "A+B" and "A-B" modes the "OVER RANGE" light comes on if either A or B is beyond full scale but not necessarily if A+B or A-B is over full scale.

1.3 Controls, Front Panel

1.3.1 "Range" Control
Function:
"SET TOL" Position: Permits setting reading of meter to desired positive or negative tolerance with the "SET READING" control.

"RANGE" Positions: Permits setting the range of the meter to the ranges listed on Section 1.2.1

1.3.2 "SET READING" Control:
Function: Setting reading of meter to desired positive or negative tolerance limit through rotation of "SET READING" control for easy setting of the +tolerance or -tolerance limit lights and outputs. This control functions only when the "RANGE" control is in the "SET TOL" mode.

1.3.3 "-TOLERANCE Control"
Function: This control sets the negative tolerance limit at which the "LOW LIMIT" Light and output come on.
Range: From beyond negative full scale to beyond positive full scale.

1.3.4 "+TOLERANCE Control"
Function: This control sets the positive tolerance limit at whcih the "HIGH LIMIT" light and output come on.
Range: From beyond negative full scale to beyond positive full scale.

1.3.5 "ZERO" Controls:
Function: These concentric controls are used for compensating for small variations in nominal probe tip to reference surface distance. The center control zeros the "A" probe, and the outer control zeros the "B" probe.
Range: .005"

1.3.6 "MODE" Control
Function:
"A" Mode: All readings and both the "mode out" and "CH A out" are for probe A, as are the tolerance limit lights and outputs.

"B" Mode: All readings and both the "mode out" and "CH B out" are for probe B, as are the tolerance limit lights and outputs.

"A+B" Mode: Meter reads sum of values for probe A and B. Tolerance limit lights are for the sum of A and B values and "MODE OUT" output and tolerance limits outputs are for sum of A and B values.

"THK" Mode: Meter reads sum of values for Probes A and B plus the offset value to give the absolute thickness. Tolerance limit lights are for the absolute thickness values and "MODE OUT" output and tolerance limits outputs are for the absolute thickness values.

1.3.7 "ON-OFF" Switch

1.3.8 "SENSITIVITY" Control
Function: Setting of the "SENSITIVITY" control permits easy calibration without case removal.
Location: Screw driver adjust on back panel of console.

1.4 Connectors and Rear Panel Controls

All connectors are located on the rear panel of the console.

1.4.1 "PROBE" Connector
Two connectors (PROBE A and PROBE B) provide for the proper connection of the Microsense 3046 console with the model 2001 driver connectors. These include all necessary ground, power and signal paths.

1.4.2 "SIGNAL OUTPUT" Connectors
Function: These BNC connectors each provide a bipolar output from a source impedance of 10 ohm. The output voltage is directly proportional to displacement.

1.4.2.1 "CH A OUT"
This connector provides an output proportional to probe "A" displacement.
Range: -10V to +10V for -10 thousandths to +10 thousandths.

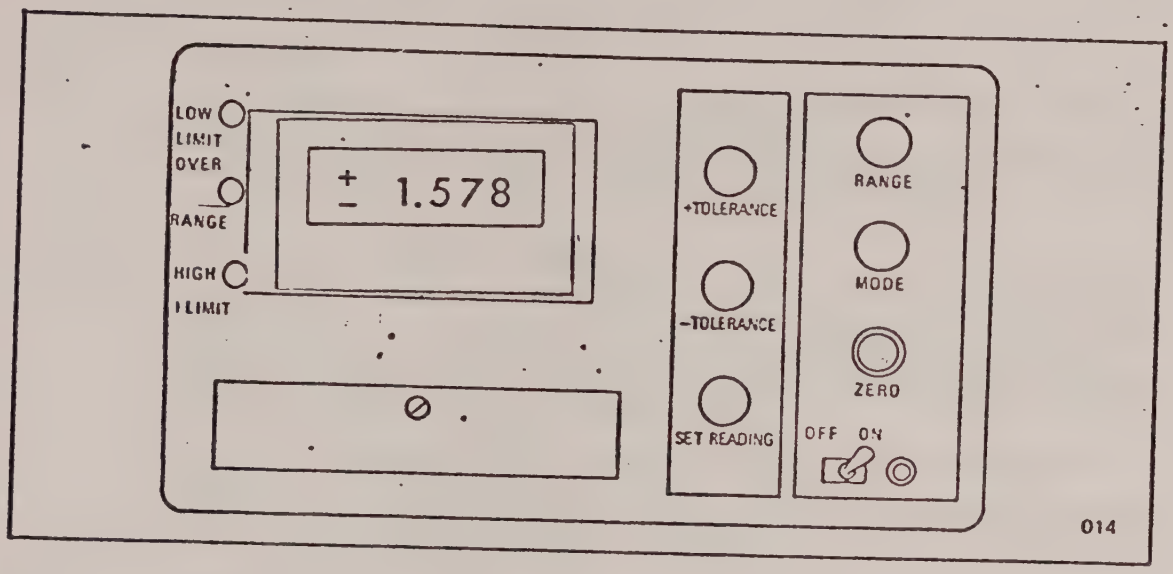

LOW
LIMIT
OVER
RANGE
HIGH
LIMIT
± 1.578
+TOLERANCE
-TOLERANCE
SET READING
RANGE
MODE
ZERO
OFF ON
014

FIGURE 1

1.4.2.2 "CH B OUT"

This connector provides an output proportional to probe "B" displacement
Range: Same as "CH A OUT"

1.4.2.3 "MODE OUT"

This connector provides an output proportional to the parameter selected at the MODE switch.
Range: -1V to +1V for full scale negative to full scale positive meter readings respectively.

1.4.3 "TOLERANCE LIMITS" Connector

Function: This amphenol MS connector provides an output voltage for high or low out of tolerance conditions which switches concurrently with the tolerance limit lights on the meter, thus, providing electrical outputs for control or remote indication.

It also provides an overrange signal which switches concurrently with the overrange light.
Range: 0 to 24V DC from a 1K source. (Separate outputs for high and low limits).

1.4.4 THK ON/OFF, THK Adjust

Function: With THK switch in ON position and MODE switch in A+B, the gage provides absolute THK measurement adjustable to a reference master with THK adjust potentiometer.

1.4.5 Power Input

Function: Input power is supplied through a hardwired three wire line cord. Power source should be a 115 VAC single phase grounded outlet.

1.5 Fuse

The fuse is mounted on the rear of the console. It is a 1/2 A 3AG type.

1.6 Probe
Overall dimensions: } See Figure 4
Tip dimensions: }
Active Gaging Area: 0.210" Diameter
Nominal Spacing for Zero: 0.0225"

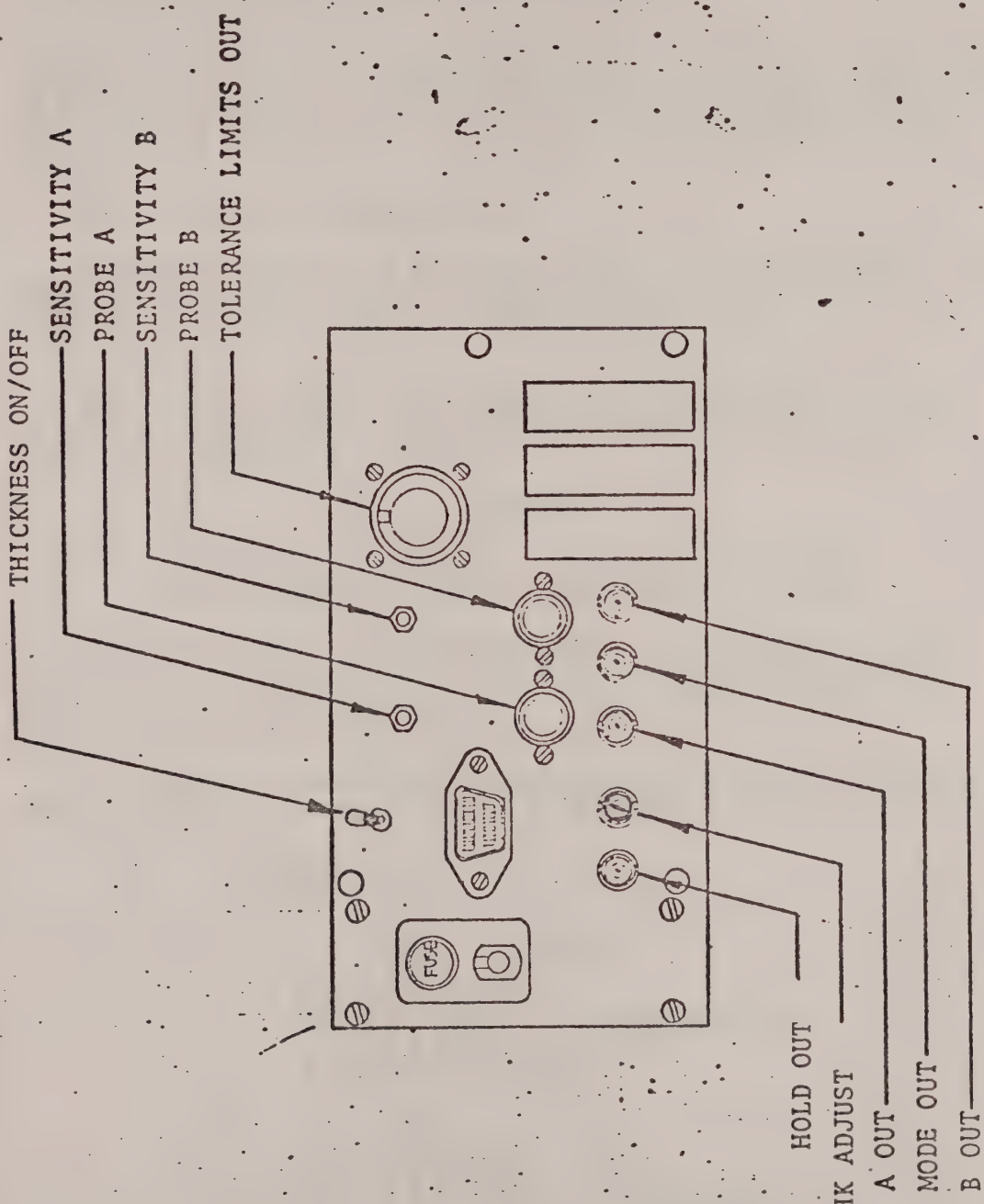


FIGURE 2

REAR PANEL, SHOWING LOCATION OF CONNECTORS AND CALIBRATION ADJUSTMENT

2.0 Setup Procedures
2.1 Setup Procedure for Thickness Measurements

The following procedures provide the best linearity of differential (thickness) measurements over the full range of positions for the part to be measured. These procedures assume that differential readings are independent of part position as long as a probe over-range condition does not exist.

Set Thickness Tolerance Limits.

Position the probes in the fixture and secure them in place. The following discussion assumes for purposes of explanation that Probe A is above and Probe B below the part to be measured.

(a) Set the RANGE switch to position "a" and the MODE switch to A. Center both ZERO controls by turning both fully clockwise and then backing off exactly 5 full turns.

CAUTION

Always make certain when rotating one of the ZERO controls that the other is not moving along with it.

(b) If the fixturing arrangement is as shown in Figure 2-1, the spacing between plates can be no more than the minimum thickness of the part to be measured plus the full scale range of one probe (e.g. 20 thousandths for ± 10 thousandths full scale).

(c) Position a round gage block against the A fixture surface as shown in Figure 2-1 Adjust probe A mechanically so that the meter reads

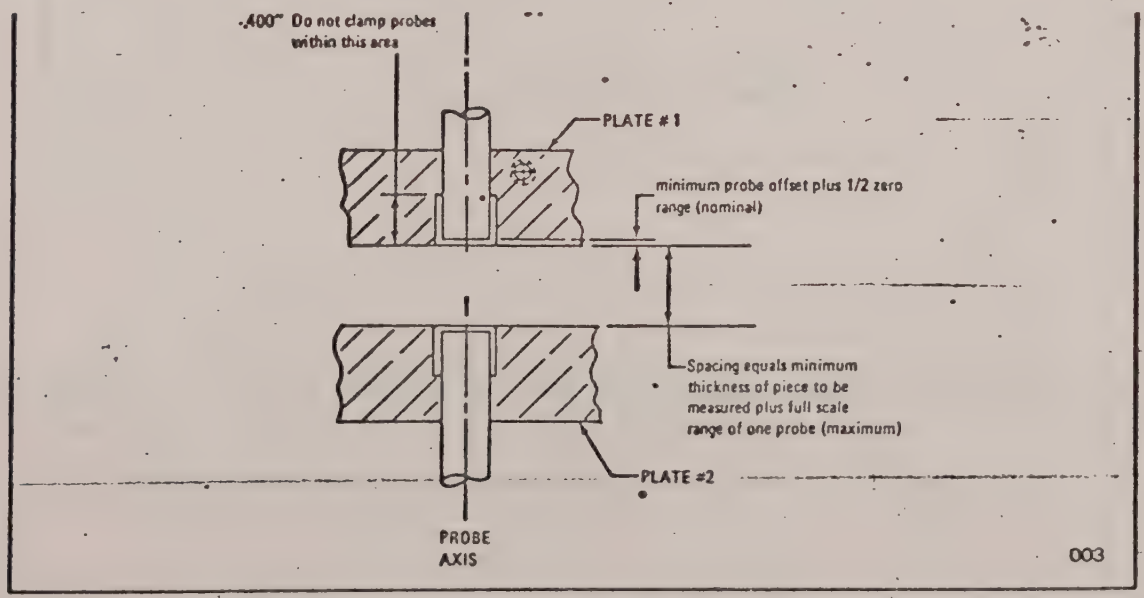

.400" Do not clamp probes within this area
PLATE #1
minimum probe offset plus 1/2 zero range (nominal)
Spacing equals minimum thickness of piece to be measured plus full scale range of one probe (maximum)
PLATE #2
PROBE AXIS
003

Figure 2-1 Thickness Measurement Fixturing

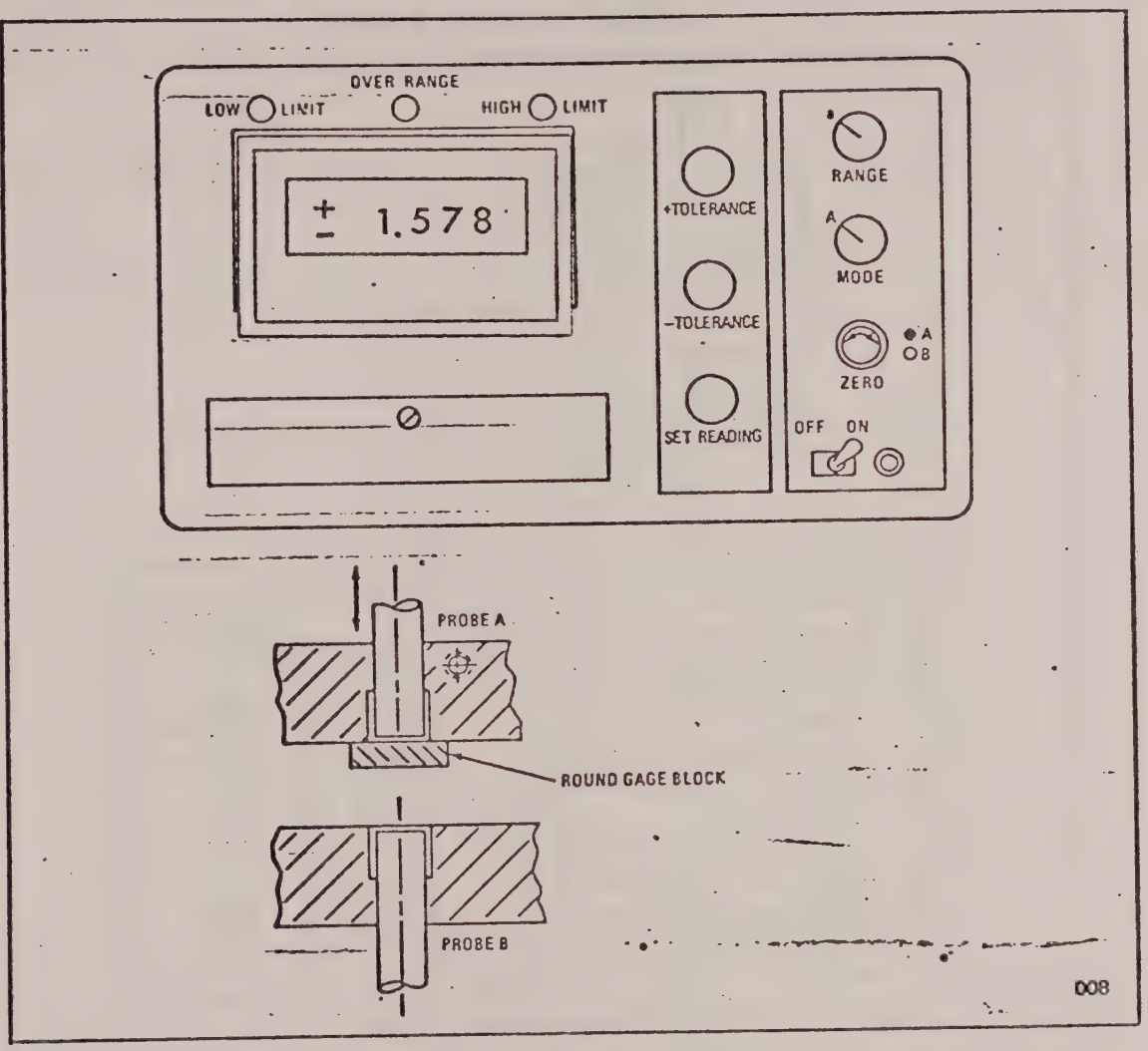


Figure 2-2 Probe A Setup

almost full scale positive (+) and clamp probe tightly in place. Adjust the ZERO A control for a full scale positive indication.

(d) Repeat steps (a) through (c) for Probe B. (Refer to Figure 2-3).

NOTE

If the passline of the part is not to be limited by plates or other stops it will be useful to provide some type of stops to limit the vertical movement of the part while performing the setup and balance procedures. These may be removed upon completion of procedures.

(e) Set the MODE switch to A. Position the nominal thickness master that is to be used for measurements between the probes. Adjust

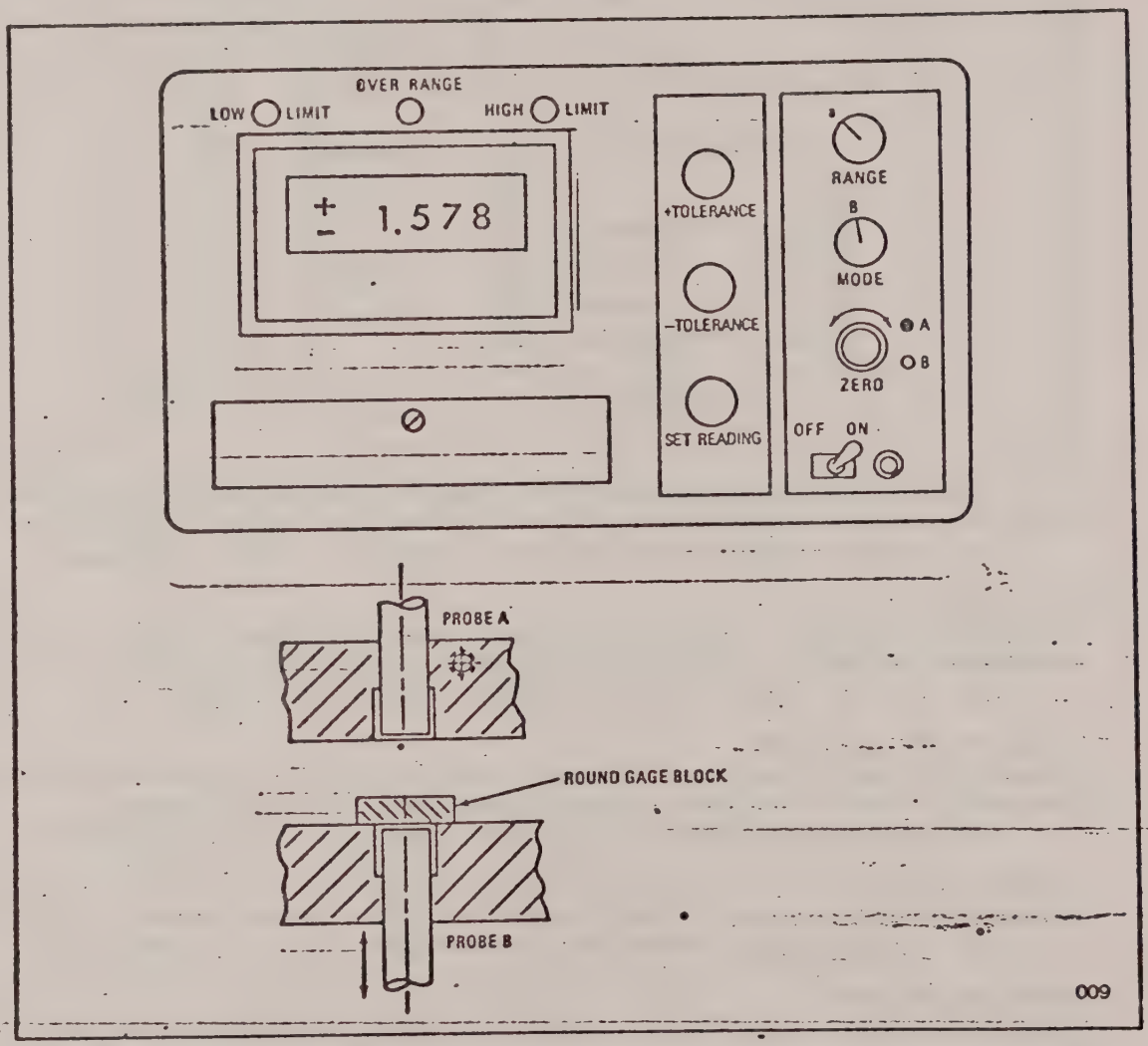


Figure 2-3 Probe B Setup

probe A mechanically so that the meter reads approximately zero, then secure probe A in place. Adjust the ZERO A control for an exact zero indication.

(f) Set the MODE switch to B and position probe B mechanically so that the meter reads approximately zero, then secure probe B in place. Adjust ZERO B control for an exact zero indication.

(g) Set the MODE switch back to A. With the nominal reference part still between probes, raise the part until the meter reads almost full scale positive. Insert a stop to limit the upper motion of the part during the setup.

(h) Set the MODE switch to B again. Lower the nominal reference part until the meter again reads the same as in step (g) above. Insert a stop to limit lower motion of part during the setup.

(i) Set the MODE switch to A + B. With the nominal reference part between the probes, move the part up and down as shown in Figure 2-4. The OVER-RANGE light should not come on for any position of the

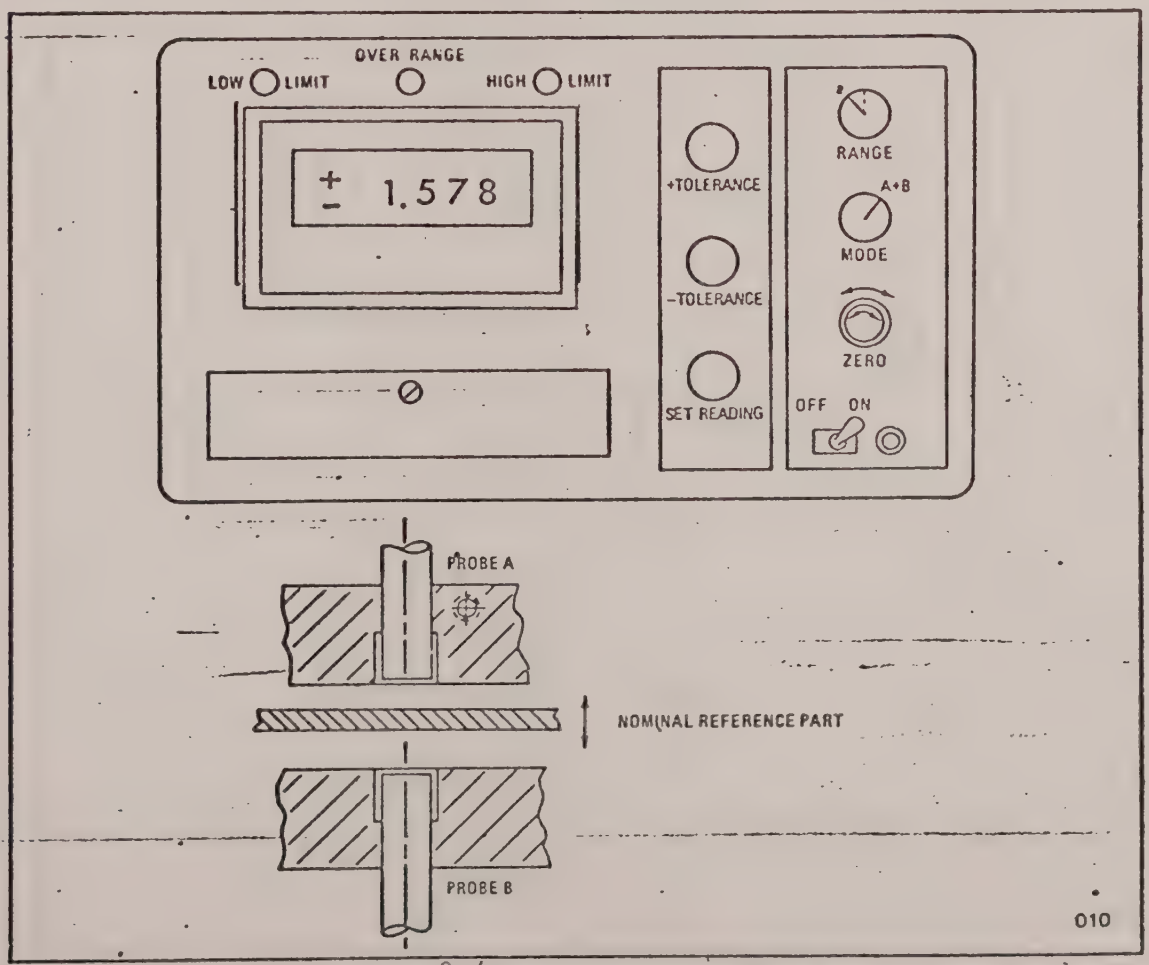


Figure 2-4 Fixturing Setup Check

part between the stops. With the nominal reference part still between probes, adjust the ZERO A and B controls simultaneously to give a zero meter indication.

(j) Set the RANGE to the most sensitive range and repeat step (i) above.

(k) The 3046A is now set up to measure thickness of parts which may vary from the nominal dimensions by no more than the full scale range of either of the probes.

2.1.1 Optional Tolerance Check

Insert a maximum tolerance master between the probes and note that the HIGH LIMIT light illuminates. Insert a minimum tolerance master and note that LOW LIMIT light illuminates.

2.1.2 Balance Check

To obtain the best possible linearity of the system once it is set up, the calibration of both probes should be balanced. This

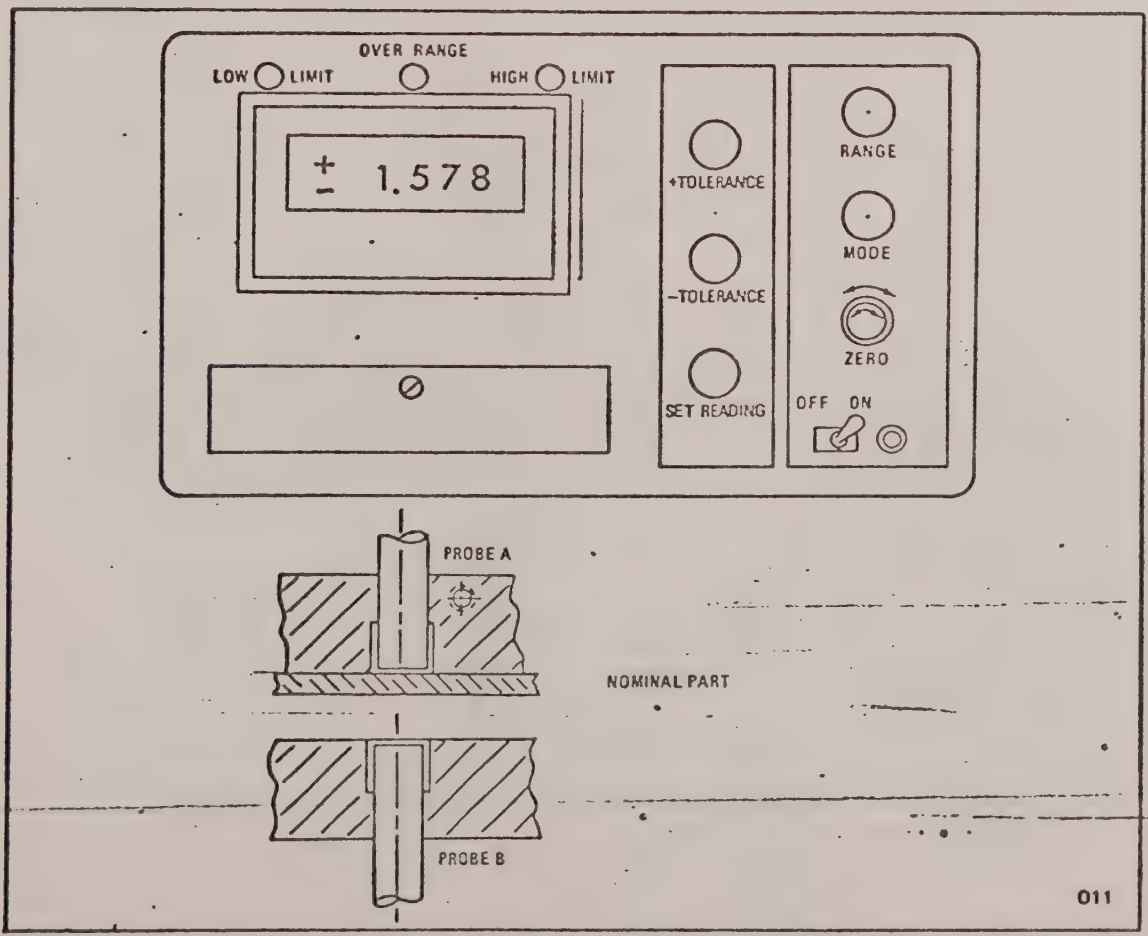


Figure 2.5 Balance Check - Step #1

3.1.14 Thickness Measurement

When making thickness measurement place the MODE switch to the A+B position. Place the rear panel THK switch to the THK position. Place a reference master in the fixture between the probes and adjust the THK potentiometer so that the front panel meter reads the known value of the master. The gage will now give absolute values for thickness measurements.

4.0 Calibration (For 3046/310 use half values given)

4.1 Calibration Check, Mode A.

4.1.1 Equipment needed.
Suitable calibrator, such as ADE Corporation Model 1701, which can be repeatably set to 2 millionths of an inch.

4.1.2 Setup.
Mount the probes in a suitable mount such as the ADE Corporation Model 1701 calibrator to permit positioning of the probe tip surface parallel to the movable reference surface of the calibrator. The calibrator should have a range of at least .035: Mount both probes for a gap of .0000 inches for a reading of 0.000000 on the calibrator.

4.1.3 Turn on the gage console and allow 1 hour equipment warm-up and fixturing "soak". Connect both A & B probe connectors to console.

4.1.4 Set the "RANGE" control to the "a" range.

4.1.5 Set the "MODE" control to "A".

4.1.6 Adjust the calibrator for +0.010".

CAUTION: Approach all calibrator settings from the same direction to prevent errors due to backlash.

4.1.7 Set the smaller knob "ZERO" control "A" to its fully CCW position.

4.1.8 Set the A probe position mechanically so that the meter on the console reads exactly full scale positive.

4.1.9 Reset the calibrator at +0.025" from the step 4.1.6 setting (that is 0.035" if step 4.1.6 setting was 0.010)

4.1.10 Set the "ZERO" control "A" to its fully CW position.

4.1.11 The meter on the console should now read exactly full scale negative.

4.1.12 If the meter did not read exactly full scale negative in the previous step, adjust the sensitivity control on the rear panal of the instrument so that it does read exactly full scale.

4.1.13 Reset the "ZERO" control "A" fully CCW and reset the calibrator to its 4.1.6 setting. Check for full scale positive meter reading. If this condition is not fulfilled

filled, repeat steps 4.1.8 through 4.1.12.

4.1.14 With calibrator set at +0.0125" set "ZERO" control "A" so that meter reads full scale negative. Mechanically set calibrator at 2 thousandths intervals from +0.0125" to +0.0325" and observe reading on meter for each setting. Compare with Table 1.

4.1.15 If these conditions are not fulfilled, repeat steps 4.1.6 through 4.1.14.

4.2 Calibration check, Mode B.
Repeat steps 4.1.1 through 4.1.15 with the "MODE" control set to "B" and make all mechanical adjustments for the "B" probe and use the large knob "ZERO" control "B".

FOR RANGE "10"

Calibrator Setting	Meter Reading
0.012	Set To -10
0.014	- 7.6 to -8.4
0.016	- 5.6 to -6.4
0.018	- 3.6 to -4.4
0.020	- 1.6 to -2.4
0.022	- 0.4 to +0.4
0.024	+ 1.6 to +2.4
0.026	+ 3.6 to +4.4
0.028	+ 5.6 to +6.4
0.030	+ 7.6 to +8.4
0.032	+ 9.6 to +10.4

CALIBRATION TABLE

TABLE I

Section 5 THEORY

5.1 INTRODUCTION TO NON-CONTACT MEASURING

Since the advent of the use of interchangeable parts in manufacturing, it has been necessary to accurately measure component dimensions. If parts are to be interchangeable, they must be very nearly the same dimensions.

Originally, items manufactured with interchangeable parts were designed to tolerances that could easily and reasonably efficiently be measured by other current mechanical equipment, such as micrometers, calipers, gage blocks and similar devices. As tolerance requirements became smaller and smaller, measurements had to be more exact. High-speed assembly lines demanded a faster method of gaging than can be provided by contact gages.

Non-contact gages were developed to eliminate the inaccuracies inherent in contact gaging due to wear at the point of contact, and to provide a faster method of measurement.

In most non-contact measurement applications, a probe emits a signal which is reflected or altered in some perceivable way by the object to be measured. A sensor, mounted with the probe, picks up the altered signal and translates it into a distance or tolerance reading.

The variables usually measured by non-contact gaging are displacement and thickness. Displacement is measured by comparing the signal reflected off a master block (known quantity) with that reflected by the object to be measured. The variation in the signals represents a variation in the distance of the two blocks from the fixed point of the probe and sensor. The signal from the master block represents zero on the scale. Any difference in the signal from the object to be measured and that from the master block becomes a positive or negative reading on the scale. This datum then may be displayed or recorded, and any out-of-tolerance specimens will be readily identifiable.

Linear correspondence between distance and signal variation, and consistent positioning of objects to be measured, are of prime importance for accurate displacement measurements.

Thickness measurement utilizes two probes. The probes are mounted a known distance apart and the object to be measured is placed between them. The sum of the measurements of the probes is compared to a corresponding sum for the master block. The difference in the sums represents the extent to which the object of the measurement is out of tolerance.

The advantage of thickness measurement lies in the relative ease of positioning of the object in question. It need only be placed somewhere between the probes and within the operating range of the probes for an accurate measurement to be made. Thickness measurement is likewise unaffected by vibrations that might be caused by a high-speed assembly line.

There are several types of non-contact measuring instruments. The majority of these instruments use one of the following principles to derive their measurements: air flow, ultra-sonic signals, light transmission/reflection, radiation, electrical eddy currents, or capacitance. The Microsense gage uses the capacitance principle.

5.2 MICROSENSE MEASURING TECHNIQUE (Figure 5-1)

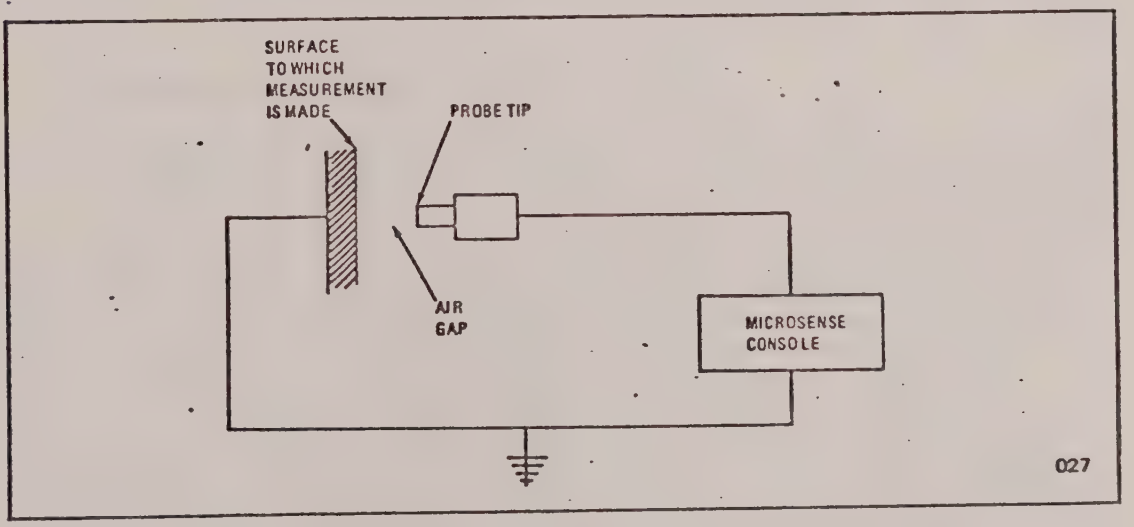


Figure 5-1 Microsense Measuring Technique

In the ADE Microsense technique any change in distance between the Microsense probe and the surface to be measured results in a change in capacitance and thus a change in the current signal from the probe to the Microsense Console. Ideally, in any capacitor the value of capacitance depends on the area of the capacitor plates, the distance between these plates and the dielectric constant of the intervening medium. In the case of the Microsense system the sensing area of the probe represents one plate of the capacitor, the surface to be measured represents the other plate and usually the intervening medium is air. The sensing area of the probe is a constant and, if the surface to be measured is extensive enough, the other plate of the capacitor formed by the surface to be measured may be assumed to have infinite area as sensed by the probe over the range of calibration. As long as the intervening medium is air the resulting capacitance thus depends only on the distance between the plates of this capacitor. The electronic circuitry in the Microsense console converts this change in capacitance with distance to a linear change in voltage with distance.

Of course not all measurement systems are ideal. First of all there are so-called fringing effects at the circumference of the plates of a capacitor which affect the relationship between distance and capacitance. The unique probe construction utilized in the Microsense capacitive method minimizes the fringing effects of the capacitive field. Thus the object-to-probe distance is the only parameter if the gage is properly used.

In some measurement situations the area of the second plate of the capacitor may not appear to be infinite (as seen by the probe) if the probe sensing area is too near the edge of the surface to be measured. In this case fringing effects of the surface to be measured may cause erroneous readouts.

In some situations the dielectric constant of the intervening medium may be different or even that of the second plate of the capacitor may be different as is the case when the medium is not air as the surface to be measured is not metal. For these situations a special calibration is required.

5.3 FUNCTIONAL OPERATION OF THE MICROSENSE 3046A

A functional block diagram of the typical 3046A is shown in Figure 5.2. The initial discussion of this figure is limited to one channel (A).

The input signal from probe A contains data which is representative of the distance from the tip of the probe to the surface being measured. This signal is applied to Linearizer A where the measurement data is amplified and made linear, and produces the LIN OUT 1 signal. The ZERO 1 signal, generated by the ZERO A control, compensates for small variations in nominal probe tip to reference surface distances that occur during initial probe positioning. This signal provides an electrical zero which can be achieved more readily and with greater precision than a mechanical zero, minimizing setup procedures and time. The INT OFFSET 1 signal from the SENSITIVITY A control, which is a rear panel-screwdriver adjustable control, is used only during the calibration procedures to insure that the 3046A operation is linear over its entire range.

The MODE switch routes the LIN OUT 1 signal to the Sum/Difference circuit. This circuit performs the sum (MODE switch set to A + B) or difference (MODE switch set to A - B) functions, or transfers the signal through if the MODE switch is set to positions A or B. The gain of the output signal from the SUM/DIFFERENCE circuit is controlled by the position of the RANGE switch. The signal from the SUM/DIFFERENCE circuit is applied to the High and Low Comparators, and to the front panel meter where the reading indicates the tolerance difference between the known standard and the part currently under test. A meter deflection towards the positive (+) direction indicates that the surface of the part being measured is closer to the probe tip than was the standard. Conversely, a negative deflection indicates a distance that is further away than the standard.

The Over Range Detector samples the measurement signal from one or both linearizers. If this signal is greater than full scale for the least sensitive range, the front panel OVER-RANGE light illuminates.

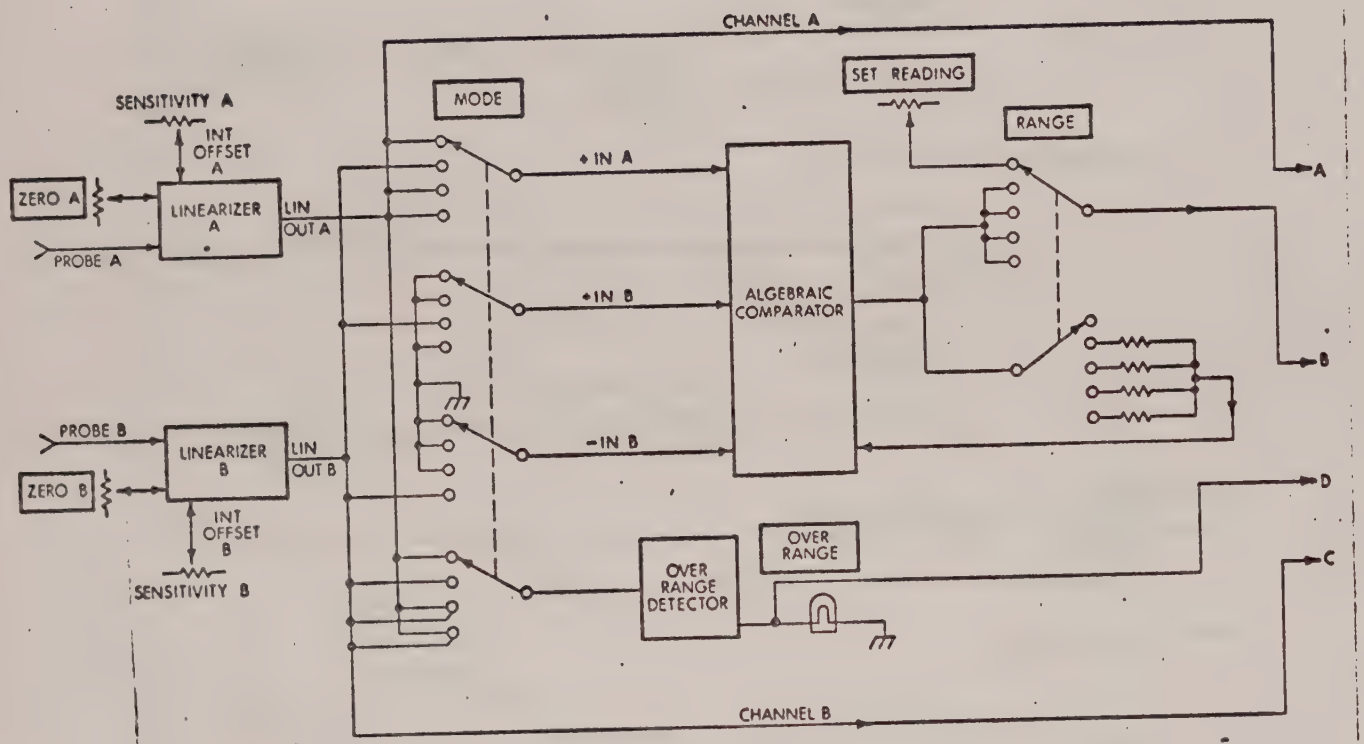


Figure 5-2 Microsense 3046A, Functional Block Diagram (1 of 2)

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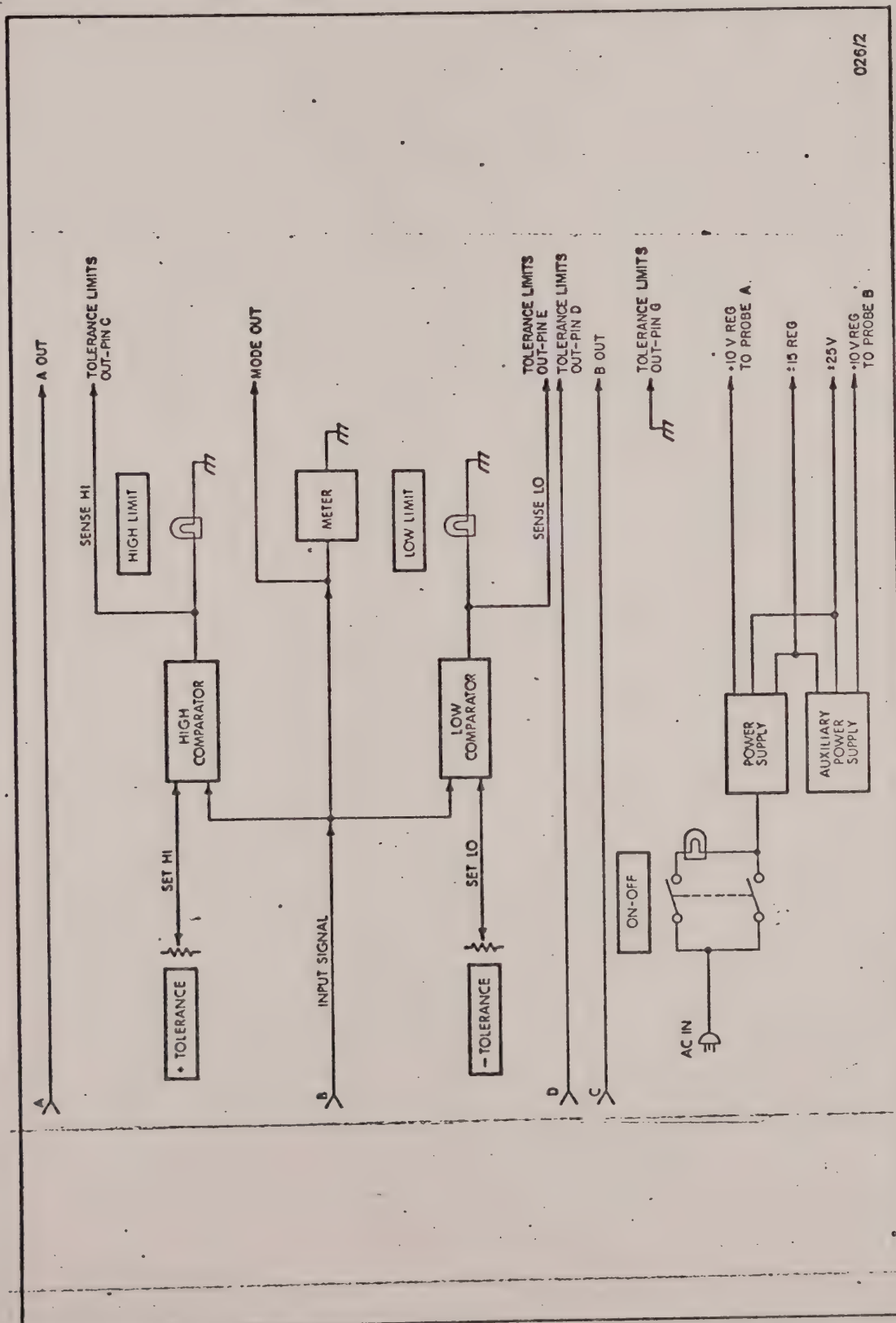

Figure 5-1 Microsense 3046A, Fuctional Block Diagram (2 of 2)

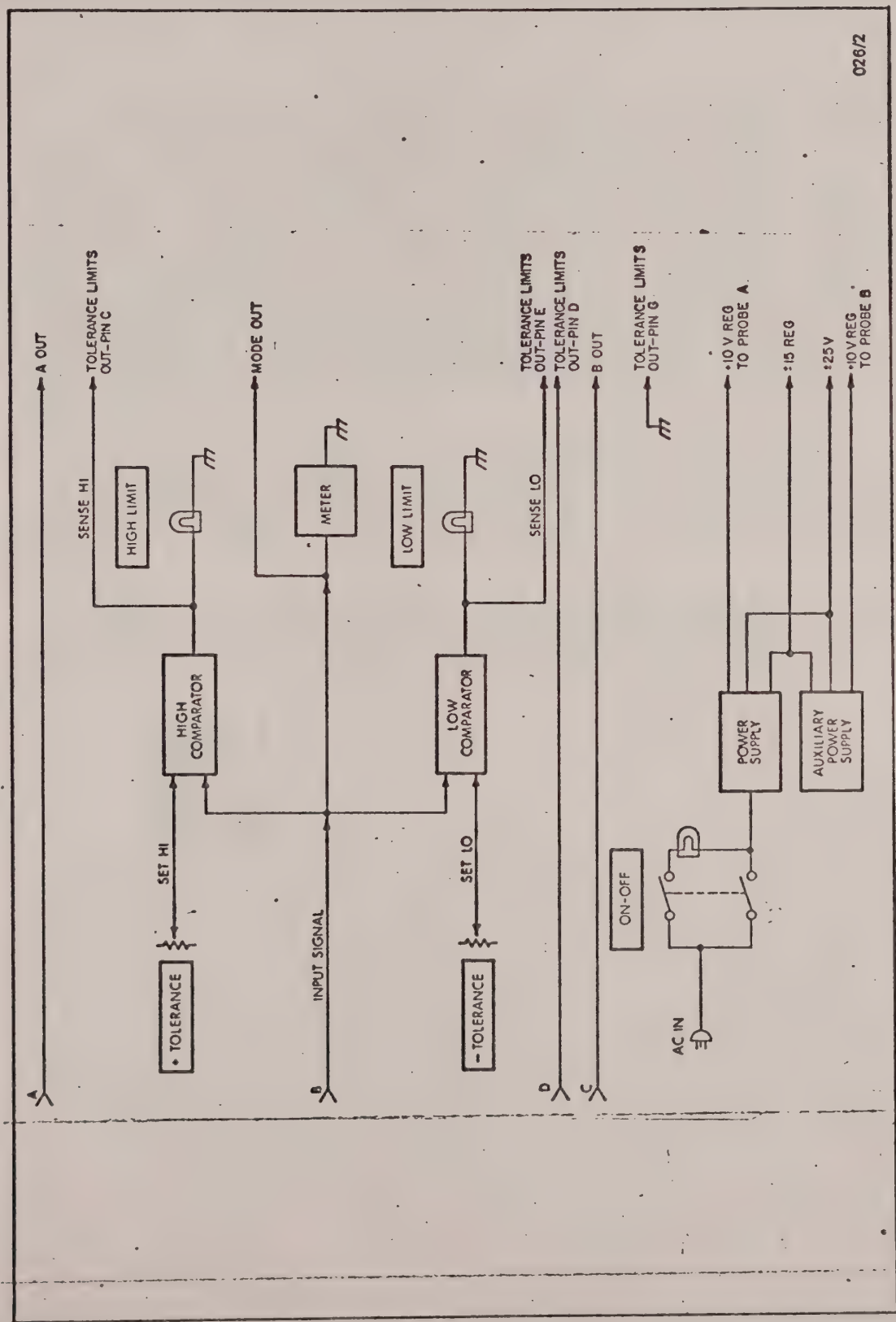

Figure 5-1 Microsense 3046A, Fuctional Block Diagram (2 of 2)

The High and Low Comparators also receive the same signal as the meter. This signal is compared with the tolerance set signals (SET 1 and SET 2). If the level of the input signal increases above or decreases below these references the HIGH LIMIT or LOW LIMIT lights illuminate. The upper and lower tolerance limits are unique to the measurement applications in which the 3046A is used. The high (+tolerance) limit is inserted in the HIGH COMPARATOR by setting the RANGE switch to the SET TOL position and adjusting the SET READING control until the meter needle indicates the maximum positive tolerance acceptable for the measurement being performed. The +TOLERANCE control is then adjusted until the HIGH LIMIT light illuminates. The lower limit is established in a similar manner using the -TOLERANCE control and the LOW LIMIT light.

The previous discussion described an input signal from probe A to the meter display. An input signal from probe B is acted upon in a similar manner except that the MODE switch is set to B. If inputs from both probes are combined, the sum or difference of the two is then displayed.

There are 6 standard output signals available at the rear of the instrument. These signals parallel the operation of the 3046A and can be used for remote monitoring of the instrument. These output signals are:

Channel A
Channel B
MODE
High Limit
Low Limit
Over Range

Section 6, TROUBLESHOOTING

6-1 TROUBLESHOOTING

Table 6-1 contains troubleshooting procedures for the 3046A console. It may be helpful to run a strip chart recorder trace of one or more gage outputs or attach an oscilloscope to the rear panel BNC outputs for analysis.

Table 6-1. Troubleshooting Table

SYMPTOM	POSSIBLE CAUSES	REMEDY
ON/OFF SWITCH LIGHT NOT ILLUMINATED WHEN POWER SWITCH SET TO ON	1. The gage is not receiving power.	1. Check to make sure unit is connected to the main power lines and that the ON/OFF switch is set to ON.
	2. The console fuse blown.	2. Check fuse. The fuse is located on rear panel. If the fuse is blown replace with 1/2 amp fast blo.
	3. Burned out indicator.	3. Replace indicator lamp.
	4. Burned out transformer.	4. If none of the above problems exist, the transformer may be burned out.
METER ALWAYS READS OFF SCALE NEGATIVE, OFF SCALE POSITIVE, OR A FIXED DISPLACEMENT	1. Probe not connected to console.	1. Check probe connector for good connection.
	2. Probe too far from part-incorrect setup.	2. Check setup procedure.
	3. Probe tip and driver not connected tightly.	3. The probe tip must be firmly screwed into driver for good electrical contact. Do not over-tighten.

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Table 6-1. Troubleshooting Table

SYMPTOM	POSSIBLE CAUSES	REMEDY
ON/OFF SWITCH LIGHT NOT ILLUMINATED WHEN POWER SWITCH SET TO ON	1. The gage is not receiving power.	1. Check to make sure unit is connected to the main power lines and that the ON/OFF switch is set to ON.
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	2. Probe too far from part-incorrect setup.	2. Check setup procedure.
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Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
	4. Faulty operational amplifier.	4. Consult factory.
	5. Probe failure.	5. If you have more than one channel, switch probes around to determine whether problem is in probe or module. Be sure to switch them back to the correct location, because each circuit is calibrated for a particular probe. If this is the problem, be sure to replace with matched set of parts, linearizer and probe.
	6. Out of tolerance.	6. Check gage master.
	7. Loose plug-in circuit card.	7. Remove case and verify proper seating of cards.
SETUP PROCEDURE CANNOT BE ACCOMPLISHED	1. Tip and driver not screwed together tightly.	1. Tip and driver are separate on some probes, and must be firmly screwed together. Do not overtighten. Do not lock together with an insulating material applied to threads.
	2. Probe connector not fully connected at console.	2. Probe connector must be firmly seated to insure proper connection.

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Table 6-1. (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
	3. Fixturing does not permit master to be brought in range of probe.	3. Alter fixturing or check masters.
GAGE APPEARS TO BE OUT OF CALIBRATION. THE READING MAY LOOK UNUSUAL OR UNREPEATABLE.	1. Dirty probes.	1. Check your probe sensing area for an accumulation of foreign matter; oil, metal chips, etc. Clean with a clean rag and alcohol (not gasoline, etc.)
	2. Out of calibration.	2. Check calibration according to Paragraph 5.5.
	3. Probes, drivers and inputs are mixed up.	3. Check to see that each probe is plugged into its proper connector on the console, and that each probe tip is mated with the proper driver. Driver and probe tip serial numbers appear on the back of each console.

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Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
APPARENT EXCESSIVE THERMAL DRIFT	1. Thermal expansion of parts or masters.	1. Fixture the probes side by side over part surface and monitor A - B output over temperature range. Any change in A - B is NOT due to thermal drift of part.
	2. Drift due to fixture thermal expansion.	2. The Microsense probes can be used to measure thermal expansion of the fixture. With a "bench setup" where the fixture becomes the measured piece and its temperature is varied while isolating the probes and their mounts from temperature variants.
	3. Temperature drift in probes.	3. By elimination one can deduce that thermal drift not caused by parts or fixturing is due to probe drift. Consult factory.

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Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
APPARENT EXCESSIVE THERMAL DRIFT	1. Thermal expansion of parts or masters.	1. Fixture the probes side by side over part surface and monitor A - B output over temperature range. Any change in A - B is NOT due to thermal drift of part.
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	3. Temperature drift in probes.	3. By elimination one can deduce that thermal drift not caused by parts or fixturing is due to probe drift. Consult factory.

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Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
	3. Always same as displacement reading.	3. Faulty circuit. Loose knob on mode control switch.
METER READING DOESN'T CHANGE, BUT REAR PANEL OUTPUTS ARE CORRECT.	1. Faulty meter.	1. Consult factory.
FRONT PANEL CONTROL INOPERATIVE.	1. Loose knob.	1. Tighten setscrews holding knob in place. If the loose knob is a pointer knob be sure to tighten in the correct angular position.
RANGE INCORRECT	1. Incorrectly positioned knob.	1. Rotate the RANGE knob fully CCW. In this position the pointer on the knob should indicate SET TOL. If not reposition the knob. If the RANGE knob is in the correct position and the range readout is still incorrect consult the factory.

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Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
	2. Faulty circuit.	2. Consult factory.
CALIBRATION CHECK CANNOT BE PERFORMED.	1. Improper fixturing.	1. Check fixturing. Is everything tightly clamped and properly grounded? Does setup permit movement of probe over its entire range?
	2. Using wrong range data for your probe.	2. Check range data for the probe being calibrated (Section 5).
	3. Not following the calibration procedure properly. Tampering with SENSITIVITY control.	3. If sensitivity control is set with the wrong conditions in effect, it may be set so far from the correct value that you will have to repeat the steps of the end pointing procedure several times to bring it to the correct value.
	4. Oscillating signal. Signal unstable or apparent non linearity of output.	4. Check grounding. Examine rear panel displacement output with oscilloscope. Consult factory.
AUXILLIARY FUNCTIONS INOPERATIVE (+PDDR, -PDDR, TIR, A + B, A - B, RADIAL RUNOUT).	1. Always full scale positive.	1. Latched operational amplifier due to overheating. Remove console from hot area. Switch power off and on to try to unlatch. Consult factory.
	2. Always zero.	2. Faulty circuit in console or broken inter-connecting wire. Consult factory.

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Table 6-1. (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
	2. If your unit has latching over range (3131 series or special order), the over range may not be reset.	2. Check resetting procedure for over range. There may be a bad relay preventing over range reset. Consult factory.
OVER RANGE LIGHT DOES NOT ILLUMINATE.	1. Burned out indicator light.	1. Check over range output on rear panel. If over range output is present at rear panel, have indicator lamp replaced.
	2. Faulty circuit.	2. Consult factory.
HIGH OR LOW LIMIT LIGHT ON ALL THE TIME.	1. TOLERANCE limit control is set wrong.	1. Check the setting of the TOLERANCE control as per Paragraph 1.3.
	2. Faulty circuit.	2. Consult factory.
	3. Latched relay.	3. If your unit has latching tolerance indicators (special order), the relay may be faulty or may not have reset properly.
LIMIT LIGHT DOES NOT ILLUMINATE.	1. Burned out indicator lamp.	1. Check limit output on rear panel. If limit output signal is present at rear panel, have indicator lamp replaced.

Table 6-1 (Cont.)

SYMPTOM	POSSIBLE CAUSES	REMEDY
UNSTABLE READINGS.	1. Unstable fixturing.	1. Check fixturing setup. Is probe tightly clamped in its fixture? Is part stable in its position?
	2. Oscillating signal.	2. Check grounding of system - probe shell to fixture to reference to part. Attach oscilloscope to BNC output on rear panel and verify whether oscillation is present in static output signal. Consult factory. Frequency of the oscillation may help ADE in analyzing the problem. If probes are in close proximity to one another unplug one probe or move probes apart and see if oscillation disappears. Consult factory.
OVER RANGE LIGHT ON ALL THE TIME.	1. Mechanical setup results in one or more of the measuring channels operating out of range at all times.	1. Check your setup. Check measuring channels individually.

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check is performed with the RANGE switch set to the most sensitive range that is going to be used in actual operation and the MODE switch set to A + B.

(a) Position the nominal part against the stop nearest Probe A as shown in (Figure 2-5). Adjust the ZERO A and B controls simultaneously for a zero meter indication.

(b) Position the nominal part against the stop nearest Probe B as shown in (Figure 2-6). Adjust the SENSITIVITY A screwdriver-adjustable control for a zero meter indication.

(c) Repeat steps (a) and (b) until no further adjustments are required.

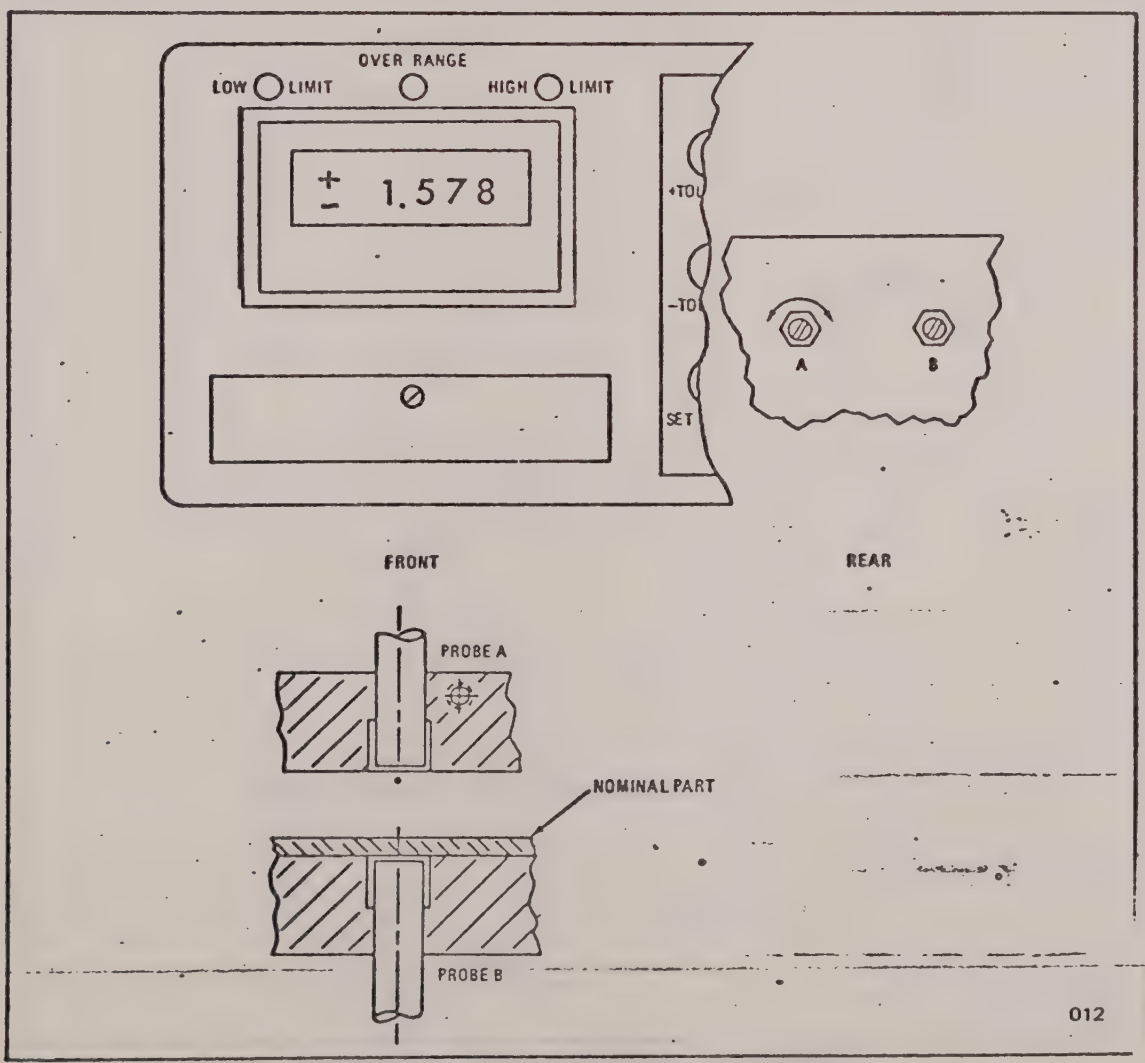

Figure 2-6 Balance Check - Step #2

(d) Position the nominal part midway between probes A and B as shown in (Figure 2-7). Keep the nominal part parallel to both fixture surfaces. Observe the meter for a zero indication. If the meter does not indicate zero, rotate both SENSITIVITY controls ¼ turn clockwise.

(e) Repeat steps (a) through (c). Check the midway setup as in step (d) and note whether the meter reading is improved (near zero) and, if necessary, repeat step (d). The degree of improvement (near zero) or worsening (away from zero) will determine the direction and amount of rotation of the SENSITIVITY A and B controls that is required. Continue to perform steps (a) through (d) until a meter reading of zero is achieved within the desired linearity tolerance. A linearity match of 0.5% of full scale is obtainable if these steps are followed carefully.

(f) If necessary, remove the stops before making measurements. The gage is now setup for normal operation.

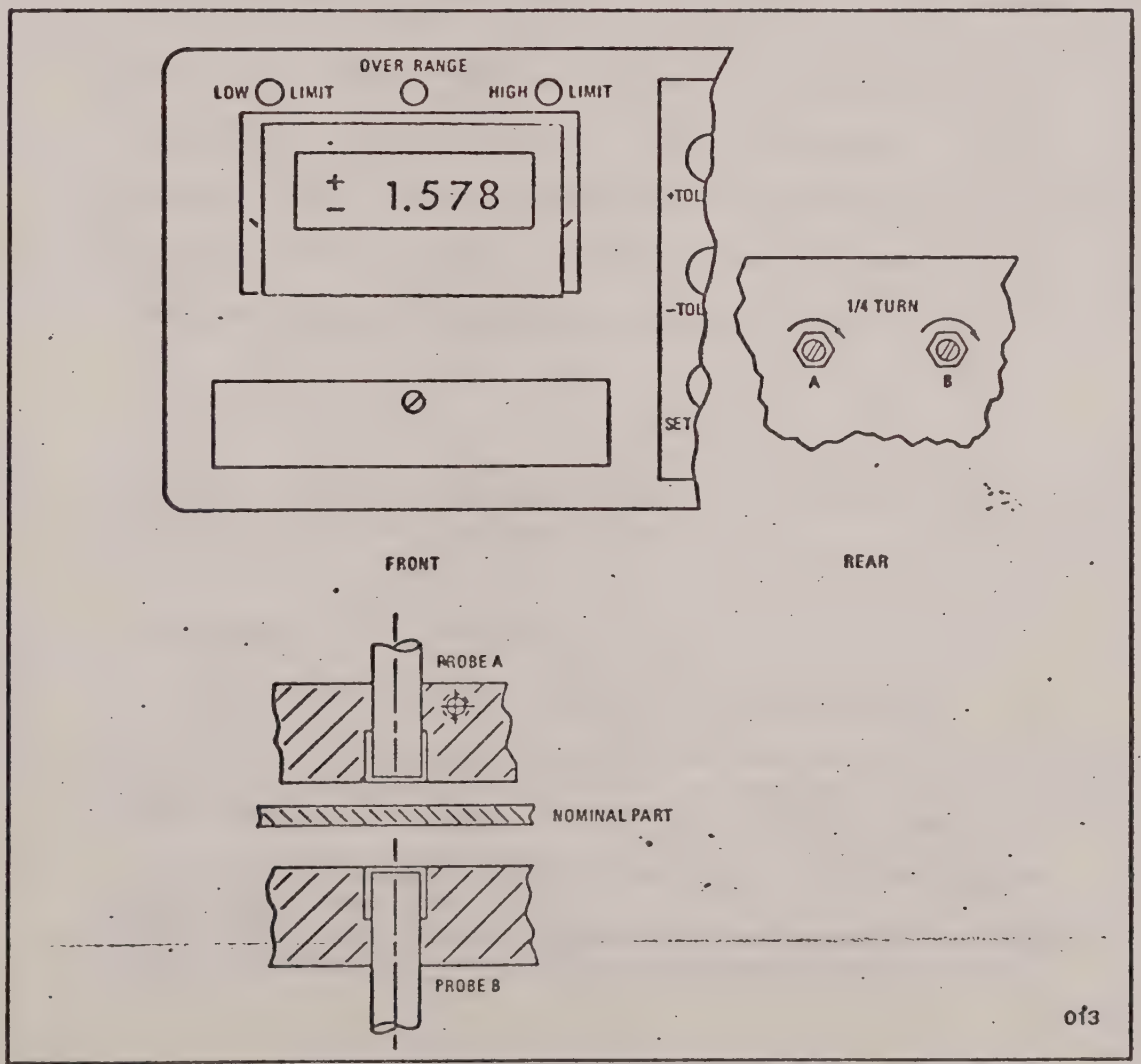

Figure 2-7 Balance Check - Step #3

3.0 Operating Instructions

3.1 Setup

3.1.1 Check calibration if necessary (See Section 4.0).

3.1.2 Mount both probes in suitable gage stand such as the ADE Corporation Model 1512 Wafer Gage Fixture (Figure 3). The gage stand should permit positioning the probe tip(s) over the surface(s) being measured, as well as over the surface of a reference gage master without disturbing the probe setup. Also the fixturing should assure the positioning of the probe tip(s) parallel to the reference plane of the gage master. In addition, the gage stand or fixture should permit positioning of the probe(s) to allow mechanical zeroing of the probe(s) with respect to the reference plane of the gage master.

3.1.3 Switch the power "ON" and allow 1/2 hour warmup.

3.1.4 Switch the "RANGE" control to the "a" range.

3.1.5 Set the "ZERO" controls both to the middle of their range.

3.1.6 Set the "MODE" control to the "A" or "B" setting.

3.1.7 Setup and Balance the gage as described in Section 2.0.

3.1.8 The gage is now setup for all modes of operation except Absolute Thickness. (See Para 3.1.14

3.1.9 "-TOLERANCE" limit setting.

3.1.9.1 Set the "RANGE" control to "SET TOL" position.

3.1.9.2 With the "SET READING" control set the meter reading to the meter position at which it is desired to have the "LOW LIMIT" light come on for the chosen range of operation.

3.1.9.3 Set the "-TOLERANCE" control so that the "LOW LIMIT" light just comes on.
NOTE: The "LOW LIMIT" light will now come on at this meter position for any of the ranges of operation.

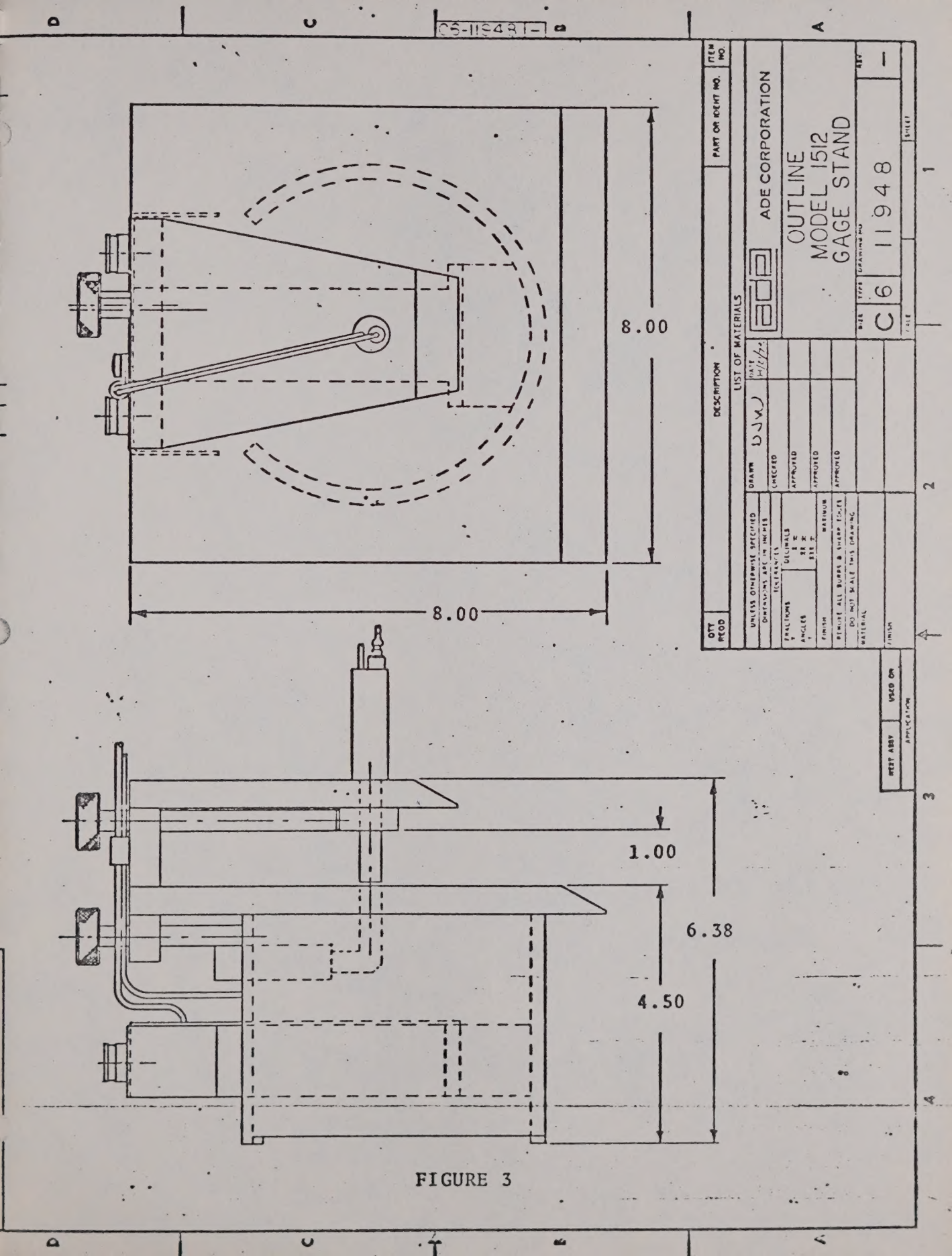
8.00
8.00
1.00
6.38
4.50
ADE CORPORATION
OUTLINE
MODEL 1512
GAGE STAND
C 6 11948 -

FIGURE 3

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